



2822

Serial No. 09/986,247
SEC.853

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of :
Min KIM et al. : Group Art Unit: 2822
Serial No.: 09/986,247 : Examiner: M. Guerrero
Filed: November 8, 2001 :

**TRENCH ISOLATION STRUCTURE HAVING A CURVILINEAR INTERFACE
AT UPPER CORNERS OF THE TRENCH ISOLATION REGION, AND METHOD
OF MANUFACTURING THE SAME**

REQUEST FOR RECONSIDERATION

U.S. Patent and Trademark Office
2011 South Clark Place
Customer Window, Mail Stop Non-Fee Amendment
Crystal Plaza Two, Lobby, Room 1B03
Arlington, VA 22202

Sir:

The Office Action of February 2, 2004 has been carefully studied and reviewed, and in view of the following representations, reconsideration is respectfully requested.

However, before Applicants proceed with these representations, the Examiner's comments in paragraph 11 of the Office Action are not well taken. The Examiner states that Applicants' previous arguments have been considered but are moot in view of new grounds of rejection. With all due respect, the Examiner has maintained the prior rejections of at least Applicants' independent claims 11 and 17 and therefore, a full consideration and written response to all of Applicants' previous

arguments was duly warranted. In this regard, attention is directed to MPEP 707.07(f) which states, in part:

Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of applicants' argument and answer the substance of it.

1. The Rejection of Claims 11 and 17 as Being Unpatentable Over Bohr (USP 5,536,675) in view of Chang et al. (USP 6,326,310) or Yoo (USP 6,033,969).

ARGUMENT - The References Lack Teachings of the Forming of a High Temperature Oxide Layer, a Middle Temperature Oxide Layer or a Plasma-Enhanced Oxide layer as a Buffer Layer

Bohr (USP 5,536,675) discloses forming a trench oxide layer 252 corresponding at best to Applicants' claimed thermal oxide layer 114, followed by filling the trench with a first oxide layer (silicon dioxide). However, Bohr fails to disclose the forming of any buffer layer just prior to the filling of the deep trench with the first oxide layer. That is, Bohr fails to disclose any step corresponding to Applicants' claimed step (f), namely the forming of a buffer layer followed by a step (g) of filling the trench, in which the buffer layer has been formed, with an oxide layer. In particular, Bohr fails to disclose the forming of a buffer layer from one of a high temperature oxide layer, a middle temperature oxide layer and a plasma-enhanced oxide layer.

In the Office Action, the Examiner refers to trench oxide layer 252b as corresponding to Applicants' claimed buffer layer. However, the layer 252b is formed

by thermal growth of the Si substrate in the presence of oxygen. On the other hand, as is well known in the art, forming a high temperature oxide layer, a middle temperature oxide layer or a plasma-enhanced oxide layer comprises a deposition process. Thus, a thermally grown oxide layer, such as the trench oxide layer 252b of Bohr, would never be considered to be a high temperature oxide layer, a middle temperature oxide layer or a plasma-enhanced oxide layer as called for in claim 11.

Moreover, a thermally grown oxide layer, such as the trench oxide layer 252b of Bohr, does not provide a buffer, in contrast to a high temperature oxide layer, a middle temperature oxide layer or a plasma-enhanced oxide layer. That is, a thermally grown trench oxide layer would allow atoms, i.e., oxygen atoms, to infiltrate the layer as would also be appreciated by those of ordinary skill in the art. Thus, the thermal growing of an oxide layer in the method of Bohr can not reasonably be considered as the forming of a "buffer layer" – the term "buffer layer" being a well known term of art. Rather, those of ordinary skill in the art would only consider the thermal growing of an oxide layer in the method of Bohr to be the forming of a "passivation" layer, i.e., a layer suitable for correcting damage imparted to the substrate during the deep etching of the trench.

Next, like Bohr, neither of the references to Chang et al. and Yoo et al. teach a trench isolation structure comprising a buffer layer and, in a particular, a buffer layer formed of a high temperature oxide layer, a middle temperature oxide layer or a plasma-enhanced oxide layer.

Accordingly, the respective combinations of references proposed by the Examiner can not render obvious claims 11 or 17 under 35 USC 103.

2. The Rejection of Claim 11 as Being Unpatentable Over Bohr (USP 5,536,675) in view of Chang et al. (USP 6,326,310)

ARGUMENT - No Motivation to Modify the Method of Bohr in View of the Teachings of Chang et al.

It is axiomatic that to establish a *prima facie* case of obviousness, based on a combination of references under 35 USC 103, the Examiner must identify suggestion that would have motivated one of ordinary skill in the art to have modified the references.

The Examiner finds that one of ordinary skill in the art would have been motivated to have modified the method of Bohr to incorporate shallow trench-forming techniques of Chang et al. into the deep trench-forming technique of Bohr “in order to use any trench profile”.

The Examiner has not established a *prima facie* case of obviousness because the suggestion to combine the references in the manner proposed by the Examiner does not come from the references.

(1) Chang et al. only suggest their method as a means of “providing **shallow** trench profile shaping”(emphasis supplied). Thus, Chang et al. provide no suggestion that would have motivated one of ordinary skill in the art to have used their technique for forming the **deep** trench of Bohr.

(2) Bohr discloses the technique of anisotropic etching by which the profile of the deep trench can be controlled, if desired (col. 6, lines 15 – 19). Thus, the very reference relied on by the Examiner herself counters her proposition that one should modify the Bohr method to obtain a “desired trench profile”.

For the foregoing reasons, including the lack of disclosure in the Bohr, Chang et al., and Yoo et al. references of a step of forming a high temperature oxide layer, a middle temperature oxide layer or a plasma-enhanced oxide layer as a buffer layer in a deep trench, it is seen that the Bohr, Chang et al. and Yoo et al. references can not render Applicants' claims obvious under 35 USC 103. Accordingly, early reconsideration and allowance of the claims are respectfully requested.

Respectfully submitted,

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Date: April 28, 2004

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